
Rescue of radiation-induced cognitive impairment through cranial transplantation of human embryonic stem cells.

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Authors: Munjal M Acharya, Lori-Ann Christie, Mary L Lan, Peter J Donovan, Carl W Cotman, John R Fike, Charles L Limoli

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Public Summary:

Scientific Abstract:

Cranial irradiation remains a frontline treatment for the control of tumor growth, and individuals surviving such treatments often manifest various degrees of cognitive dysfunction. Radiation-induced depletion of stem/precursor cell pools in the brain, particularly those residing in the neurogenic region of the hippocampus, is believed, in part, to be responsible for these often-unavoidable cognitive deficits. To explore the possibility of ameliorating radiation-induced cognitive impairment, athymic nude rats subjected to head only irradiation (10 Gy) were transplanted 2 days afterward with human embryonic stem cells (hESC) into the hippocampal formation and analyzed for stem cell survival, differentiation, and cognitive function. Animals receiving hESC transplantation exhibited superior performance on a hippocampal-dependent cognitive task 4 months postirradiation, compared to their irradiated surgical counterparts that did not receive hESCs. Significant stem cell survival was found at 1 and 4 months postirradiation, and transplanted cells showed robust migration to the subgranular zone throughout the dentate gyrus, exhibiting signs of neuron morphology within this neurogenic niche. These results demonstrate the capability to ameliorate radiation-induced normal tissue injury using hESCs, and suggest that such strategies may provide useful interventions for reducing the adverse effects of irradiation on cognition.

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